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HENRY W. HENSHAW, Chief.

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SECOND ANNUAL REPORT OF BIRD COUNTS IN THE UNITED STATES, WITH DISCUSSION OF RESULTS.

By WELLS W. COOKE, *Assistant Biologist.*[1]

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INTRODUCTION.

A preliminary enumeration of the birds on many farms of the United States, made during the summer of 1914, was so satisfactory and the information obtained so important that it was decided to repeat the work in 1915. In the second effort it was planned to cover as many different kinds of country as possible and particularly to secure more records and more reliable data concerning birds in the Gulf States and in the region from the Plains westward.

The returns from the 1915 bird count were on the whole very satisfactory. As in 1914, the largest number of reports from any single section came from the Northeastern States—that is, the States north of North Carolina and east of Kansas—but they are particularly gratifying because of their close agreement with returns of 1914 from the same section. When an enumeration of birds was first suggested the project was the subject of much good-natured banter and some criticism from those who declared the scheme utterly visionary.

[1] Shortly after writing this report, and following a very brief illness, Professor Cooke died, March 30, 1916. He was a prominent ornithologist and the foremost American authority on the migration of birds.—EDITOR.

NOTE.—This second report on the number and relative abundance of wild birds (see Dept. Bull. 187, issued Feb. 11, 1915) is for the information of workers and others interested in the protection and increase of birds.

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The reports of 1914 from farms of the Northeastern States agreed so well among themselves and with results obtained by other persons in previous years that they seemed to warrant the belief that their average closely approximated the actual facts. The counts of 1915 from the same region serve to strengthen this belief and to make it practically certain that the conclusions drawn as to the number of birds on these farms is very nearly accurate.

A word of explanation may be offered as to just what results were expected from the work, and also as to what phases of the bird population question are not covered by these first two years of bird counting.

The most important factor of bird life concerns its relation to human beings and has to do with its influence for good in helping the farmer destroy the foes of his crops. Hence to ascertain the numbers of birds in the trees and shrubbery on the acres actually devoted to crops and immediately contiguous thereto is more important economically than on other lands, and these numbers have been most in mind in the work thus far conducted. The principal question of these two years has been, therefore, What kinds of birds and how many pairs of each kind nest on the farms in the area surveyed and remain on or near them during the middle of the summer, when crops grow fastest and also suffer most from insect enemies?

So far as the farms of the Northeastern States are concerned, the average of the 1914 counts was about one pair of birds to the acre, and as this number is so nearly the same as presented by the additional work of 1915, it may be said with reasonable assurance that this is the average bird population of that part of the Northeastern States actually devoted to agriculture.

The work has not yet reached the stage where the general average found—in the Northeastern States of nearly 800 pairs of birds to the square mile—may be subdivided and an estimate made of the number of pairs of each kind. For some of the commonest and most widely distributed species, like the robin and English sparrow, however, the reports are probably sufficiently numerous to permit an approximate estimate.

The different kinds of birds on a farm are so much more variable than the average number of birds per acre that it will require many more counts to serve as reliable bases for formulating averages of species. Two contiguous farms of 100 acres each may each support 100 pairs of nesting birds, yet the kinds of birds on the two farms may vary widely, according as one farm is upland, and the other lowland; one devoted to grain raising, and the other, in permanent pastures, to dairying; one supporting a growth of hardwood trees, the other showing nothing but evergreens.

Many phases of bird population have scarcely been touched by the two years' work. How many birds to the acre inhabit permanent marshes? What effect on the number of birds has the presence of a stream, a river, a pond, or a lake? What is the average effect of altitude or latitude on bird life? These and many other questions are interesting and important, but may not yet be answered.

Another important question concerning bird population, which is partially covered by the counts of 1914 and 1915, relates to the numbers of birds inhabiting those areas near large centers of human population which are not devoted strictly to agricultural purposes, as city lots, parks, cemeteries, etc. It is, of course, desirable to have the greatest possible numbers of native birds in all such places, and some of the returns show in a very striking manner how quickly and abundantly the birds respond to efforts to make these sections better adapted to a large bird population.

A brief explanation should be made regarding the qualifications needful in an observer to result in a satisfactory enumeration. The Biological Survey has for many years had several hundred migration observers throughout the country reporting bird arrivals and departures. If a person is familiar with only half a dozen of the commonest birds and is well situated to note the earliest arrivals among these species, his notes on the birds he knows are just as valuable, so far as they go, as those of one who has a wider bird acquaintance. But in counting birds such partial knowledge is worse than useless. If a bird count is to have value, it must be true not only as far as it goes, but it must tell the whole truth. This requires that the enumerator be able to identify with certainty all the birds nesting on the area he covers, or be able to give a recognizable description of those he is unable to name. Lack of such knowledge has made unusable some reports which were undoubtedly correct as to the species listed, but which showed their incompleteness by absence of records for the smaller and less conspicuous birds.

Letters of criticism of the method used for counting the pairs of birds have been received. Of course if one is living on the area on which he reports and has the time and inclination to go over the ground repeatedly, day after day, until each nest has been actually located, his report would be more accurate and valuable than one made by ear by the method outlined in the circular of instructions. But this would require twenty to fifty times as many hours' observation, and hardly more than one person in a hundred would feel inclined or be able to devote so much additional time to the work. Some six years of such work done by the writer convinced him that a person who knows the birds by their songs can use the method advocated and obtain, with the expenditure of a minimum of time and effort, a count that will compare favorably in accuracy with the most pains-

taking and exhaustive hunting out of the nests themselves. During two different years, in less than three hours of one morning, he made a survey of a 50-acre field which was supporting a bird population of some 30 species and about 75 pairs, and obtained results so nearly correct that continued observation on the field for the remainder of the season made scarcely any change in the figures thus obtained.

PLANS FOR THE 1915 COUNTS.

As the returns from the 1914 counts had shown that the method pursued gave satisfactory results, the same method was employed in 1915. A circular of detailed instructions was sent to each person who offered to help in the work. This was widely distributed; calls for additional bird enumerators also were inserted in the principal

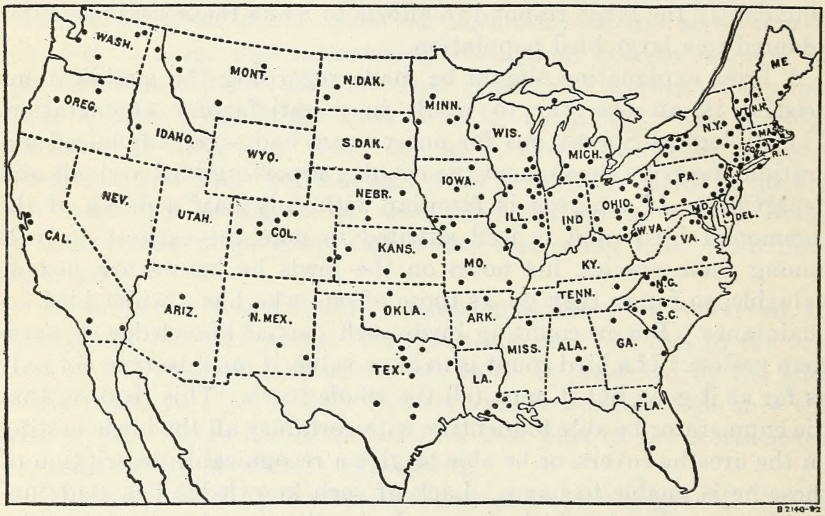

FIG. 1.—Places from which bird-count reports were receivevd in 1915.

ornithological journals; and in various other ways the matter was brought to the attention of those interested in birds. As a result about 315 reports, from every State in the Union, except Utah and Nevada, were received in 1915. As shown by the accompanying map (fig. 1), these are fairly well scattered over the country, but the largest proportion comes from the northeastern part of the United States, as was the case in 1914.

RESULTS IN THE NORTHEASTERN STATES.

The bulletin publishing the results of the bird enumeration of 1914[1] discussed at some length the work on farms of the Northeastern States. The most interesting phase of the 1915 returns is a consideration of the two counts from the same section to see whether the agreement is close enough to indicate accuracy in the 1914 conclusions.

[1] Bull. 187, U. S. Dept. Agr., Feb. 11, 1915.

The number of new reports received from this section in 1915 was almost exactly the same as the total number received in 1914. This new material has been treated with reference to the same points considered in 1914, and the comparison of the results of the two years is given in the subjoined table.

The average farm in the Northeastern States, according to the 1910 census, contains 108 acres, and a farm of this size was used as the basis of the calculations for each year.

TABLE I.—*Results of counts in northeastern United States.*

	1914	1915	Average for 2 years.
Average area covered by each count	*Acres.* 58	*Acres.* 64	*Acres.* 61
Plowed land	17	21	19
Hay land	8	6	7
Orchard	4	5	5
Woodland	3	9	6
Land around buildings	3	3	3
Permanent meadow	8	6	7
Pasture land	15	14	14
Average bird population on each area covered	*Pairs.* 69	*Pairs.* 80	*Pairs.* 75
Average bird population for each 100 acres of the area covered	119	125	122
Average bird population on each 100 acres of isolated woodland	175	199	187
Average area not covered by the count in each farm	*Acres.* 50	*Acres.* 44	*Acres.* 47
Plowed land	15	13	14
Hay land	7	6	6
Woodland	18	16	17
Meadow and pasture	10	9	10
Probable average bird population in the woodland	*Pairs.* 31	*Pairs.* 32	*Pairs.* 32
Probable bird population on the remainder of the area	14	12	13
Probable bird population on each 108-acre farm (estimated from average of count area and area not covered)	114	124	119

The results of the counts of 1915 agree so very closely with those of 1914 as to indicate the strong probability that each represents on the average a close approximation to the truth.

Some 25 persons who sent in reports of bird counts in 1914, taken on farms in the Northeastern States, made reports the next year of counts taken on the same areas. The average of these for 1914 is 117 pairs of native birds to each 100 acres of farm land, while the average for 1915 is 122 pairs.

Combining all the 1915 counts from farms in the Northeastern States with those of 1914 which were not repeated in 1915—that is, combining the counts of all the different farms received in the two years—gives the following results, expressed in the same terms as those used in the report of the 1914 enumeration:

The average enumeration area on farms in the Northeastern States is 61 acres, i. e., it consists on the average of the farm buildings and the grounds surrounding them together with approximately

half the land of the farm, leaving an average of 47 acres of land farthest from the buildings not covered by the count. Thus two problems are presented: First, how the 61 acres covered by the census compare with the average farm; and, second, how the remaining 47 acres compare in bird population with the 61 acres chosen.

That portion of the average farm covered by the enumerations contained 32 per cent of plowed ground and 10 per cent of hay land, which, according to the 1910 census, is nearly the average percentage for the farms in this section of the United States. There is, however, a great difference in the relative sizes of orchards; these farms contained 7.3 per cent of orchard, whereas the average for the Northeastern States is only 1.2 per cent, or, in other words, the area selected for the bird enumeration contained six times as many acres of orchard as the average. Each area also contained the farm buildings with accompanying shade trees, ornamental shrubs, small fruits, and vegetable gardens, forming the most favorable nesting sites on the farm and affording the largest quantity of food per acre. There is no doubt that the average 5 acres immediately surrounding the farm buildings contain more birds' nests than any other 5 cultivated acres on the farm. As the farms selected contained orchards larger than the average and as orchards are especially preferred for nesting sites by many kinds of birds, the areas selected evidently have a bird population denser than that of farm lands as a whole.

During each of the years 1914 and 1915, counts were made on isolated areas of woodland, and the average of all reports in the two years gives a bird population of 187 pairs to each 100 acres, while the farm land supported 122 pairs per 100 acres. It is evident, then, that comparatively small areas of woodland contiguous to cleared and cultivated land offer better attractions as nesting sites than land which is wholly under cultivation, and contain a correspondingly larger number of birds' nests.

The 47 acres not covered by the two-year counts on each of these farms consisted on the average of 14 acres of plowed ground, 6 acres of hay land, 17 acres of woodland, and 10 acres of meadow and pasture. If the 17 acres of woodland contain on the average, as they probably do, 32 pairs of birds, the other 30 acres would have to support a bird population of 26 pairs to give these 47 acres the same bird population per acre as the part of the farm where the buildings are situated. It is not probable that the 30 acres would have 26 pairs, but they may easily have half that number, which, added to the population of the woodland and of the enumeration area, would make a total of 119 pairs on 108 acres, practically an average of 1 pair to the acre for the land in farms in the Northeastern States.

RESULTS IN OTHER SECTIONS.

In the report on the 1914 bird count it was stated concerning the data received that year from the whole of the United States outside the northeastern section—

> Less than a dozen reports came from the South Atlantic and Gulf States, and the number is no larger from the States west of the Rocky Mountains; while the reports from the Plains States—North Dakota to Oklahoma—are too few to be used as representing average conditions in this region. These three divisions, the South, the West, and the Plains, are so diversified in climate and agricultural conditions and vary so widely in their bird life that many more bird censuses must be available before generalizations can be made for the whole country and reliable conclusions drawn.

The reports received in 1915 from the South, the West, and the Plains, instead of yielding a satisfactory bird return from these districts, serve rather to accentuate the difficulties of the problem. Deductions from a few of these, following, will show the wide variations and indicate the complexity of bird life in these parts of the United States.

COUNTS IN THE PLAINS REGION.

Of a number of reports received from the Plains region from Oklahoma to North Dakota, only those were selected which seemed to have resulted from counts made under about average conditions. These covered an average area of 56 acres, divided into 15 acres of plowed land, 5 acres of hay land, 1 acre of orchard, 3 acres of woodland, the farm home with the other buildings and farm garden, and the remainder, 29 acres, divided into about one-fourth meadow and three-fourths pasture. The percentage is a little smaller than the average for these States in plowed land and hay land, about the average in meadow and pasture, and considerably above it in woodland and orchard. As these last two are the largest factors in the size of the bird population, it follows that these enumeration areas probably have a larger bird population per acre than the average for the States as a whole.

The average of these reports shows 70 pairs of nesting birds of 22 species on the 56 acres, or at the rate of 125 pairs to the 100 acres, precisely the same as for farms in the Northeastern States, which contained the farm home and exceptionally favorable conditions for a large bird population.

But while these figures are probably entirely correct for the part of the farm which contains the buildings, it is not possible to estimate from any data yet received the bird population on the remainder of the farm outside the enumeration area. The farms in the Plains region are large, averaging 297 acres each, as compared with only 108 acres in the Northeastern States. The part of the average Plains farm not covered by the bird count consists of 241 acres,

divided into 92 acres of plowed land, 27 acres of hay land, 3 acres of woodland, 34 acres of improved meadow and pasture land, and the remainder, 85 acres, of wild, treeless, native prairie. The average bird life per acre on such land is naturally much less than on the part of the farm selected for the enumeration. How much less, the data in hand are not sufficient to determine. Anyone who has ridden over the native prairie knows how seldom birds are seen, and an attempt was made at Sisseton, S. Dak., to obtain a numerical statement of this scarcity. On a tract of 40 acres of prairie pasture land adjoining the Sisseton town site, but having better than average conditions, in that a stream of water, bordered with brush, crossed the tract, the following were found nesting: Killdeer, 2 pairs; prairie horned lark, 3; Sennett nighthawk, 2; lark bunting, 2; and meadowlark, 3; a total of 12 pairs on 40 acres, or at the rate of 30 pairs to 100 acres, as compared with the 125 pairs to 100 acres of the farm land.

Some suggestive figures in this connection come from Onaga, Kans., where a tract of 80 acres of native pasture, crossed by a creek with a narrow fringe of native timber and occupied at one end by a small cornfield, supported a population of 31 pairs of native birds of 22 species, or in the proportion of about 40 pairs to 100 acres. The adjoining 40 acres, containing the farm home, a 5-acre orchard, and 6 acres of groves, was the summer home of the same number of kinds of birds represented by 49 pairs, or at the rate of 122 pairs to 100 acres.

REPORTS FROM THE ROCKY MOUNTAIN STATES.

The foregoing records from the Plains region are from the part east of the one hundredth meridian, where the average annual rainfall is more than 20 inches and where crops are raised successfully without irrigation. To the west, as the rainfall diminishes, the native bird population on the open prairie decreases until in some of the more desolate sections it almost disappears.

A little west of the one hundredth meridian, near Hobbs, N. Mex., in the extreme southeastern corner of the State, one tract of 80 acres, all native pasture except a 20-acre field of milo maize, had a bird population of 22 pairs representing 9 species; a neighboring 80 acres, with only 10 acres in milo maize, showed 17 pairs of 8 species; while in the same township still a third 80 acres, none of which had ever been disturbed by the plow, was supporting only 13 pairs of 5 species, notwithstanding each of these equal areas contained a set of farm buildings with windmill and tank. The average of these three counts is 17 pairs to 80 acres, or 21 pairs to each 100 acres.

Still farther west, in the irrigated district of western Colorado, two reports have been contributed showing the effect of irrigation on the density of bird life. The first area consisted of 320 acres of irrigated

orchard, near Grand Junction, the trees from 3 to 6 years old; the area was interspersed with small fields of alfalfa, grain, and root crops, and contained about ten sets of farm buildings, sheds, and yards for live stock. The native birds were represented by 116 pairs of 17 species (in addition to a colony of 65 pairs of violet-green swallows, most of which had come within the last few years), 5 pairs of English sparrows, and 12 pairs of the introduced California quail; a total of 198 pairs of birds on the 320 acres. Just above this irrigated land lay a tract of 320 acres in its original wild state, of low hills and small gullies; the hills sparsely covered with sage, saltwort, and other desert plants, and the gullies lined with bushes. Its bird life consisted of the following pairs: Burrowing owl, 3; Arkansas kingbird, 1; Say phœbe, 1; desert horned lark, 5; western lark sparrow, 2; white-rumped shrike, 2; and rock wren, 3; a total of 17 pairs of 7 species. The irrigated land supported a bird population at the rate of 66 pairs to 100 acres, while on the contiguous nonirrigated land the bird life shrank to 5 pairs to 100 acres.

A 40-acre tract on the outskirts of Tombstone, Ariz., containing in one corner a few houses with their yards, but for the most part covered with a sparse growth of desert shrubs, "not heavy anywhere, but quite general," and with no surface water, had a bird population of 50 pairs of 26 species, of which only 4 species were seed-eaters and the rest insectivorous. At a little distance from the town a 40-acre tract of "semidesert" covered with a rather heavy growth of brush, mostly less than 6 feet high, showed 31 pairs of 16 species. No enumeration has yet been made on the real desert. In the mountains of Arizona, near Flagstaff, a tract of 70 acres at about 7,100 feet elevation, covered with western yellow pine and Gambel oak, supported a bird population of 31 pairs of 18 species.

A public park in Missoula, Mont., with exceptionally favorable conditions for bird life, showed 59 pairs of 20 species on 40 acres. Along the shore of Flathead Lake, Mont., 45 acres of woodland had 67 pairs of 24 species. A tract of 48 acres near Missoula, Mont., with 6½ acres in orchard and the rest in native prairie, furnished a home in the orchard for 16 pairs of birds, while only 4 pairs could be discovered on the 40 acres of shrubless prairie.

These examples make it plain that there is a much smaller bird population per acre west of the one hundredth meridian than in the Northeastern States. Just how much smaller can not be estimated from the reports so far received.

Probably no State in the Union has greater variations in bird life than California. A few examples will show some of these, though it will require many more bird counts than those so far made to furnish an adequate basis for estimates of averages. A plot of 20 acres of the campus of the University of California, with conditions

for birds much more favorable than average, showed 87 pairs of 23 species of native birds. A 60-acre tract of wooded hillsides near Gilroy, Cal., was supporting 36 pairs of 10 species. This is close to what would be expected in the Eastern States under similar conditions.

There is no place on the farm where the help of birds is more needed than in the orchard, and the following counts show how the birds congregate where food, shelter, and building sites are closely associated. The numbers of nesting pairs in a tract near Gilroy, Cal., containing an orchard of 30 acres of apricots, prunes, peaches, and grapes, and about 8 acres of pasture and creek bottom, the farm home and other buildings, and many large native trees, are as follows: Oregon towhee, 4; California towhee, 12; valley quail, 5; killdeer, 1; green heron, 3; California woodpecker, 3; red-shafted flicker, 7; western bluebird, 8; western meadowlark, 1; Bullock oriole, 2; Arkansas kingbird, 2; Traill flycatcher, 4; black phœbe, 6; Lawrence goldfinch, 15; lazuli bunting, 1; barn owl, 3; dotted canyon wren, 2; western winter wren, 7; long-tailed chat, 1; California shrike, 2; tree swallow, 5; cliff swallow, 12; California jay, 4; Allen hummingbird, 6; western blue grosbeak, 1; black-headed grosbeak, 8; house finch, 18; western mourning dove, 6; western chipping sparrow, 10; Pacific nighthawk, 2; russet-backed thrush, 2; western lark sparrow, 7; green-backed goldfinch, 2; and English sparrow, 4; a total of 176 pairs of 34 species on 38 acres.

A similarly dense, though less varied, bird population in a 52-acre peach orchard is shown by a count made near Port Clinton, Ohio. This showed 108 pairs of common farm birds, a colony of 36 pairs of purple martins, and 6 pairs of English sparrows, or a total of 150 pairs of 29 species.

ESTIMATED BIRD POPULATION OF THE SOUTHERN STATES.

Bird counts made in Florida show an average of 77 pairs of native birds of 20 species and 5 pairs of English sparrows on 83 acres. The enumeration areas average 4 per cent of plowed land, 21 per cent of woodland, and the remainder open meadow or pasture land. The average of the farms of the State is 12 per cent of plowed land and 60 per cent of woodland, so that the proportion in the enumeration areas does not at all represent average conditions in that State, and the counts can not be used in estimating the average bird life of the State.

Reports from Louisiana show an average of 95 pairs of birds of 29 species on 53 acres, of which 39 per cent is plowed land, 18 per cent woodland, and 41 per cent pasture, while the average farm of the State contains 87 acres, of which 28 per cent is plowed land, 41 per cent woodland, and 28 per cent pasture.

The enumerations from Texas average 91 pairs of birds of 21 species on 60 acres, composed of 43 per cent plowed land, 17 per cent woodland, and 40 per cent pasture; while the average farm of the State contains 270 acres, divided into 15 per cent plowed land, 25 per cent woodland, and 60 per cent pasture.

The average of all counts received from the Southern States, North Carolina, Arkansas, and Oklahoma to Florida and Texas, is 76 pairs of birds of 23 species on a farm of 58 acres, which consists of 33 per cent plowed land, 2 per cent hay land, 24 per cent woodland, and 41 per cent meadow and pasture land. The average farm for this section contains 120 acres, divided into 24 per cent plowed land, 2 per cent hay land, 35 per cent woodland, and 39 per cent meadow and pasture. The enumeration areas thus differ too radically from the average farm conditions to allow safe generalizations, and yet it is worthy of notice that the average for the census areas in this southern section is 131 pairs of nesting birds to 100 acres, while for the Northeastern States the corresponding figure is 125 pairs, and for the Plains region 125 pairs. There is probably more than a mere coincidence in the close agreement of these figures, and they seem to indicate that on the average the farmhouse area and the approximately 60 acres surrounding it support about the same bird population—76 pairs of nesting birds—in all the States east of the one hundredth meridian.

There is still left unsolved the problem of the bird population on the areas in the South and in the Plains region which are not included in the reports. These areas in the Northeastern States constituted only 41 per cent of the total land of the farms, while in the South they form 52 per cent of the whole, and in the Plains region 81 per cent.

From the 59 per cent of the land covered by the count it is possible in the Northeastern States to estimate with fair accuracy the birds on the 41 per cent not covered, but it is not at all safe to generalize in the South, with less than half the farm area represented by the count, and still less so in the Plains region, where less than a fifth of the area is included.

THE NUMBER OF BIRDS CAN BE INCREASED.

The most important fact brought out by the 1914 count was that the average bird population on the farms of the United States can be largely increased by protection and furnishing food and shelter. The 1915 count presents several more instances of a numerous bird population following well-directed efforts for its increase. A farm of 65 acres near Westerville, Ohio, comprising plowed land 23 acres, hay land 22 acres, pasture 5 acres, orchard 5 acres, house and garden plot 2 acres, and swamp and wooded

creek borders 8 acres, showed a population of 110 pairs of native birds and 25 pairs of English sparrows, or about double the average for the State. A farm of 78 acres near Strasburg, Ohio, with about the same proportion of the different fields, had 126 pairs of native birds and 8 pairs of English sparrows, also about double the average. A farm of 40 acres near Middletown, Conn., containing 10 acres of plowed land, 3 acres of woodland, 5 acres of pasture, 12 acres of orchard, and 20 acres of meadow, had a bird population of 165 pairs of native birds, 8 pairs of English sparrows, and 15 pairs of starlings; a total of 188 pairs, or more than four times the average. A farm of 40 acres at New Hope, Pa., called "The Hedges," from its numerous osage orange hedges, and divided into plowed land 15 acres, woodland 2 acres, orchard 5 acres, and grassland 18 acres, supported a bird population of 136 pairs of native birds, 17 of English sparrows, and 1 of the starling; a total of about four times the average.

These examples are all of farms that are used for ordinary farming purposes, and where no attempt has been made to attract an extra number of birds by winter feeding or by putting up nesting boxes. The large bird population is due solely to absolute protection and to leaving abundant chances for favorable nesting sites.

THE BERWYN, PA., BIRD COUNT.

As noted in the report of the 1914 enumeration, the first published bird count in the United States was that made in 1901 at Berwyn, Pa., by Mr. Frank L. Burns. After a lapse of 13 years Mr. Burns in 1914 repeated the count on the same area, and the results have lately been published.[1] His enumeration area consisted of 640 acres, divided approximately into 27 per cent woodland, 16 per cent gardens and shaded lawns, about 30 per cent plowed land, and the remainder, about 27 per cent, covering pasture land, drives, highways, and railroads. The tract is thus somewhat more favorable for birds than the average of the lands covered in 1914 and 1915 by the Biological Survey reports. In his second count Mr. Burns found 617 pairs of native birds on the 640 acres as compared with 588 pairs in 1901, or an average of 97 pairs of native birds to 100 acres as compared with the 100 pairs estimated for 1914 by the Biological Survey for the farms of the Northeastern States. If English sparrows are included, however, Mr. Burns's total is 112 pairs to 100 acres, as compared with the 105 pairs found by the Biological Survey in 1914. Mr. Burns finds 95 pairs of English sparrows on the 640 acres, or at the rate of 15 pairs to 100 acres, where the Biological Survey's average is 5 pairs. Mr. Burns finds 15 pairs of English sparrows to each

[1] Burns, Frank L., Second Sectional Bird Census, 1914, Taken at Berwyn, Chester County, Pa. Bird-Lore, XVII, 109–111, March–April, 1915.

100 pairs of native birds, while the Biological Survey's estimate is 5 pairs. Based on his count, Mr. Burns estimates 165,000,000 individual English sparrows in the United States east of the Mississippi River, but this may be somewhat too high for the whole area, since the English sparrow is especially partial to human society and the square mile worked on by Mr. Burns contained more than one person to the acre, or a human population thirty times as dense as the average for farm land in the United States east of the Mississippi River, and several times the average density for the whole land including cities.

SOME NOTABLE REPORTS.

The most elaborate report to the Biological Survey in 1915 was that of the campus of Cornell University, at Ithaca, N. Y. Its 256 acres was divided into six blocks, and the survey of each was made by a different person, the whole being in charge of Prof. Arthur A. Allen, of the university. Following is a description of each of the six blocks:

Block A, 22 acres, hillside pasture with a few trees; block B, 34 acres, hillside planted with scattered groups of trees and shade trees about residences, with very little shrubbery; block C, 87 acres, containing lawns, shade trees, a little shrubbery, and most of the university buildings; block D, 24 acres, about one-third woodland, containing residences with shade trees and some shrubbery; block E, 64 acres, a clover field, a small nursery, a little woodland, and many new buildings; block F, 25 acres, a hillside pasture covered with a thicket of thorn apple and containing a stream.

It is interesting to note the wide variations in the bird population of the various sections. Block C, which contains the university buildings and therefore has the largest human population, hundreds of students passing and repassing all day, has less than the average of native birds but swarms with English sparrows, in numbers almost equal to the total of the native birds. Block D, containing residences, with their shade trees and shrubbery, has the greatest density of native bird population—84 pairs on 24 acres; and blocks A and F, hillside pastures, though supporting a population of native birds considerably above the average for the State, are almost free from English sparrows. (See Table II.)

Another count, representing great and painstaking work, was made by M. S. Crosby on Grasmere Farms, near Rhinebeck, N. Y. A 210-acre section containing 92 acres of woodland, 38 acres of plowed land, 25 acres of meadow, 40 acres of orchard, and 15 acres of lawns, drives, gardens, and buildings, was found to have a bird population of 54 different kinds represented by 366 pairs, or an average of 174 pairs of native birds to 100 acres, nearly the same as on the Cornell University campus.

TABLE II.—*Number of nesting pairs on each of six blocks of the Cornell University campus.*

Species.	Blocks.						Total.
	A.	B.	C.	D.	E.	F.	
Screech owl	1			1			2
Spotted sandpiper						1	1
Kingfisher						1	1
Hairy woodpecker				1			1
Downy woodpecker					1	1	2
Flicker	2		1	1	1	1	6
Chimney swift			4				4
Ruby-throated hummingbird			1		1		2
Phœbe	1	1		1	2	2	7
Wood pewee	1	2	3	6	4	3	19
Least flycatcher		1	1			3	5
American crow				1			1
Bobolink					1		1
Cowbird	1			2	1	2	6
Meadowlark	1	1	1		1		4
Baltimore oriole	3	2	7	4	1	4	21
Bronzed grackle			2				2
American goldfinch	3		2	2	11	5	23
Vesper sparrow		1	1		3	2	7
Savannah sparrow			4		3		7
Chipping sparrow	7	4	18	9	6	3	47
Field sparrow		1			1		2
Song sparrow	4	6	3	5	2	11	31
Scarlet tanager				1			1
Cedar waxwing	2				1	2	5
Red-eyed vireo		1	4	5	2	1	13
Warbling vireo			3	1			4
Yellow-throated vireo				4	2	1	7
Yellow warbler	2	2	11	2	1	12	30
Louisiana water-thrush				2			2
Maryland yellow-throat		2					2
Redstart		1		8	5	1	15
Catbird	1	2	3	2	1	7	16
House wren	1		1	1			3
White-breasted nuthatch	1			3			4
Chickadee	1	1	1	1			4
Wood thrush		1		1			2
Wilson thrush	1			5	1	1	8
Robin	8	36	35	15	6	11	111
Bluebird	1	1					2
Total pairs of nesting native birds	42	66	106	84	58	75	431
English sparrow	3	15	87	15	17	4	141
Ring-necked pheasant	1						1
Total number of different species	21	19	21	26	24	22	42
Total pairs of nesting birds	46	81	193	99	75	79	573
Acres per block	22	34	87	24	64	25	256
Nesting pairs of native birds per 100 acres	186	200	122	350	77	300	166
Nesting pairs of English sparrows per 100 acres	14	44	100	62	27	16	56
Total nesting pairs per 100 acres	205	244	222	412	104	316	225

In comparison with the above may be placed a report from Rantoul, Ill., on a farm of 400 acres, of which 315 acres were in corn and oats, and of course practically destitute of birds' nests, leaving only 85 acres to support the 88 pairs of native birds found on the place. Such farms are very common throughout the central corn belt, and while the 88 pairs are about the average for the 85 acres, the farm as a whole shows an average of only 22 pairs to the 100 acres.

The count for 1914 showed an average of 6 pairs of robins and 5 pairs of English sparrows for each farm (of 108 acres) covered. The accuracy of these figures has been called in question by individuals who felt sure that the English sparrow was by far the most

abundant bird in the Northeastern States. The reports for 1915 in this part of the Union bear out the estimates for 1914 that the robin is the more numerous, since the averages are 8 pairs of robins and 6 pairs of English sparrows for each farm. The average of all reports for the two years shows 7 pairs of robins and 5½ pairs of English sparrows for each farm covered.

VARIATIONS IN BIRD LIFE FROM YEAR TO YEAR.

A most interesting and instructive report has been received from Mrs. A. B. Morgan, of Woodstock, Vt., giving the results of enumerations for each of the last eight years on a tract near Woodstock. The tract contains 92 acres, 20 acres of which is woodland, the balance being devoted to permanent pasture and the usual crops of a Vermont farm. The conditions on the farm have scarcely changed during the eight years and the bird life has not much altered—84 pairs of birds in 1915 as compared with 87 pairs in 1908—but it is interesting to note the wide variation in both kinds and numbers of each registered in the annual counts.

The total number of species nesting on the place in the eight years aggregates 49, while the highest number in any one year is 44 and the lowest 35, a range of from 90 per cent to 72 per cent of the total. The average number of nesting pairs per year is 82, with variations from 77 to 87, or an average variation of 3 per cent and a maximum variation of only 6 per cent. These variations have been attributed chiefly to the depredations of hawks. (See Table III.)

A tract of 50 acres at Viresco, Va., came under the writer's observation in 1907. It consists of woodland, 21 acres; plowed land, 5 acres; permanent pasture, 15 acres; and the remainder, 9 acres, brushy land along a stream and on a hillside. At that date much of the land not in woods had lately ceased to be cultivated and was growing up in brush, while the underbrush had just been thoroughly cleared out of all the woods. In the last eight years the underbrush has worked back into the woods, while a great increase has taken place in the brush and young trees along the stream and on some 3 acres that were formerly cultivated. During all the years bird life has been rigorously protected, but there has been no extra bird feeding either winter or summer and no putting up of bird boxes, with the exception of a single small martin house; this, however, was scorned by the martins, which are on several neighboring farms, but was used fitfully by bluebirds, house wrens, and crested flycatchers.

A bird count was made by the writer in each of the last five years, and the results show a steady and pronounced gain in the number of kinds of birds nesting about the place, and a still greater gain in the

total number of nesting pairs. Indeed, the gain in this latter respect, 69 per cent in the five years, is more than may be explained by the growth of bird food and shelter on the place and is probably due to the entire freedom from disturbance which the birds have come to recognize.

TABLE III.—*Kinds of birds, and number of pairs of each, nesting each year from 1908 to 1915 on a tract of 92 acres near Woodstock, Vt.*

Species.	1908	1909	1910	1911	1912	1913	1914	1915
Bluebird	1	1	1	1	.....	.....	1	1
Robin	2	2	2	1	1	1	.....	1
Wood thrush	.....	.....	1	1	1	1	2	2
Wilson thrush	2	2	2	2	3	3	2	2
Hermit thrush	4	4	4	4	4	4	3	3
White-breasted nuthatch	1	1	.....	.....	.....	.....	.....	.....
Black-capped chickadee	3	3	3	2	1	2	3	3
Catbird	1	.....	.....	.....	.....	.....	.....	.....
Brown thrasher	1	1	1	.....	.....	.....	.....	1
Black and white warbler	1	1	1	1	1	1	.....	1
Yellow warbler	1	1	.....	.....	.....	.....	.....	.....
Black-throated blue warbler	.....	.....	1	.....	.....	1	1	1
Chestnut-sided warbler	2	2	2	2	2	2	2	2
Black-throated green warbler	.....	.....	.....	1	1	1	1	1
Oven-bird	2	2	2	2	2	2	2	3
Maryland yellow-throat	1	.....	.....	1	.....	1	.....	1
Redstart	1	1	1	1	1	1	1	.....
Red-eyed vireo	3	3	3	3	3	3	3	3
Yellow-throated vireo	1	1	.....	.....	.....	.....	.....	1
Solitary vireo	2	2	2	2	2	2	2	2
Barn swallow	2	2	3	3	3	4	4	1
Scarlet tanager	1	2	1	1	1	1	1	1
Purple finch	1	1	.....	.....	.....	.....	.....	1
American goldfinch	1	1	1	1	1	1	1	1
Vesper sparrow	12	12	12	12	12	12	12	11
Savannah sparrow	4	4	3	3	3	3	2	3
Chipping sparrow	1	1	1	1	1	1	1	1
Field sparrow	2	2	.....	2	2	2	2	3
Song sparrow	7	7	6	6	6	6	6	9
Rose-breasted grosbeak	1	1	1	1	1	1	1	1
Indigo bunting	1	1	1	1	1	1	1	1
Baltimore oriole	1	1	.....	.....	.....	.....	.....	.....
Prairie horned lark	.....	.....	.....	.....	.....	.....	.....	1
Kingbird	1	1	1	1	1	1	1	1
Crested flycatcher	1	1	1	1	1	1	1	1
Phœbe	1	1	1	1	1	1	1	2
Wood pewee	2	2	2	2	2	2	2	2
Least flycatcher	1	1	2	2	1	1	1	1
Ruby-throated hummingbird	1	1	1	1	1	1	1	1
Chimney swift	3	3	3	3	3	3	3	1
Nighthawk	3	1	1	.....	.....	.....	.....	.....
Hairy woodpecker	3	3	3	3	3	3	3	2
Downy woodpecker	2	2	2	4	4	3	2	2
Yellow-bellied sapsucker	.....	1	2	4	4	4	4	4
Flicker	2	2	2	2	2	2	2	2
Black-billed cuckoo	1	1	1	1	.....	.....	.....	1
Screech owl	1	1	.....	.....	.....	.....	.....	.....
Ruffed grouse	1	1	1	1	1	1	1	1
Upland plover	1	1	1	1	1	1	1	1
Total number of different species	44	43	38	38	35	37	35	42
Total pairs of nesting birds	87	85	79	82	78	81	77	84

It is interesting to note the change in the character of the bird population from year to year. While 42 kinds of birds nested on the place in the course of the five years, the greatest number in any one year was only 34, while each year a dozen or more kinds of birds nested within sight of the 50 acres, but not within the enumeration area itself. (See Table IV.)

TABLE IV.—*Kinds of birds, and the number of pairs of each, nesting on a 50-acre tract at Viresco, Va., during each of the five years, 1911 to 1915.*

Species.	1911	1912	1913	1914	1915	Species.	1911	1912	1913	1914	1915
Bluebird	.....	.....	1	.....	1	Song sparrow	6	6	6	5	3
Southern robin	1	.....	.....	.....	.....	Field sparrow	3	3	4	4	7
Wood thrush	.....	1	1	2	2	Chipping sparrow	.....	1	1	1	1
Carolina chickadee	.....	1	1	.....	1	Grasshopper sparrow	1	1	1	.....	.....
Tufted titmouse	1	1	1	2	2	Orchard oriole	.....	.....	.....	1	.....
House wren	1	.....	2	1	1	American crow	.....	1	.....	1	1
Carolina wren	1	1	.....	.....	1	Blue jay	.....	.....	.....	.....	1
Brown thrasher	.....	.....	1	.....	.....	Acadian flycatcher	.....	1	1	1	2
Catbird	3	2	4	5	7	Wood pewee	2	1	2	3	2
Black and white warbler	1	1	2	2	3	Phœbe	2	1	1	1	3
Parula warbler	.....	1	.....	.....	.....	Crested flycatcher	1	.....	1	1	1
Oven-bird	3	4	4	6	6	Kingbird	.....	1	1	.....	.....
Maryland yellow-throat	4	4	5	3	5	Ruby-throated hummingbird	.....	.....	1	.....	.....
Chat	2	2	1	3	2	Whip-poor-will	1	1	.....	1	1
Hooded warbler	1	.....	1	1	2	Downy woodpecker	1	1	1	.....	1
Redstart	1	2	2	2	4	Hairy woodpecker	.....	.....	.....	1	.....
White-eyed vireo	1	1	3	3	2	Mourning dove	.....	.....	.....	.....	1
Yellow-throated vireo	1	2	2	5	2	Bob-white	.....	.....	.....	.....	1
Red-eyed vireo	2	3	4	9	7						
Rough-winged swallow	1	1	1	1	1	Total number of different species	27	30	32	29	34
Scarlet tanager	1	2	2	2	1						
Indigo bunting	3	3	1	3	3						
Cardinal	1	2	2	2	2	Total pairs of nesting birds	48	53	63	74	81
Towhee	2	1	2	2	1						

THE POSSIBILITIES FROM BIRD PROTECTION.

To increase the number and variety of birds about the home, whether in the country or in the city, has become the laudable desire of an increasingly large number of persons. Among the reports are examples of such decided successes in these endeavors that a few in detail will be of interest.

Two city blocks, 10 acres in all, in the town of Aiken, S. C., have for many years been liberally supplied with bird food and water. In the summer of 1915 the following nests were counted: Blue jay, 14; red-headed woodpecker, 11; mockingbird, 9; brown thrasher, 8; catbird, 7; cardinal, 6; wood thrush, 4; orchard oriole, 1; towhee, 1; English sparrow, 4; total, 10 species and 65 nesting pairs. This shows a large number of nesting birds comprising a comparatively small number of species, the blue jay and the red-headed woodpecker being the most numerous.

At Olney, Ill., Mr. Robert Ridgway has devoted 8 acres of land to homes for birds. His aim is to have the greatest possible variety, and of course as many individuals of each as is consistent with this, but a great number of different kinds is considered more important than mere numbers of individuals. As a result of more than ordinarily favorable natural conditions, supplemented by the planting of different kinds of shrubbery for bird food and shelter, furnishing a superabundance of nesting boxes, and supplying an unlimited quantity of food all the year and water through the summer, these 8 acres have become the summer home of 70 pairs of native birds of 31 species, as follows: Mourning dove, 13; screech owl, 2; yellow-billed cuckoo, 1;

red-headed woodpecker, 1; flicker, 2; chimney swift, 1; ruby-throated hummingbird, 1; kingbird, 1; crested flycatcher, 2; wood pewee, 2; alder flycatcher, 1; blue jay, 3; cowbird, 1; meadowlark, 1; orchard oriole, 2; Baltimore oriole, 1; bronzed grackle, 3; goldfinch, 1; chipping sparrow, 1; field sparrow, 1; towhee, 1; cardinal, 2; indigo bunting, 1; Maryland yellow-throat, 1; catbird, 3; brown thrasher, 3; house wren, 8; tufted titmouse, 1; Carolina chickadee, 1; southern robin, 7; bluebird, 1. Mr. Ridgway's experience with some of these birds in their relations to their fellows may be stated in his own words.

> The red-headed woodpecker, although one of our most strikingly handsome birds, and in many ways a most interesting one, is, unfortunately, extremely selfish and aggressive. Our single pair prevented any other woodpeckers (the downy, hairy, and red-bellied) from nesting in any of the boxes, drove two pairs of flickers and one pair of crested flycatchers from boxes which they had chosen, and even attacked the purple martins whenever they alighted on the box put up for them. * * * The house wren is equally tyrannical, and no other small bird can nest in his vicinity. Several pairs of Carolina chickadees and tufted titmice, and a pair of Bewick's wrens that had been with us all winter, would have nested in boxes near the house but for the rascally house wrens, who, though possessing boxes of their own, drove the other birds away.[1]

His most interesting experiences, however, were with the blue jays and the grackles. The blue jays were very troublesome, destroying fully 90 per cent of the eggs in the first-built nests and even killing and partly devouring half-grown young of the mourning dove. It became necessary to "discourage" the blue jays and the grackles to the extent of 15 pairs of the former and some 50 pairs of the latter before the smaller birds had a fair chance for existence. Parenthetically it may be remarked that on the grounds of the Department of Agriculture at Washington, D. C., the grackles have been known to feed upon newly hatched English sparrows, while the young of the grackles, and to even a greater extent of the English sparrows, also, similarly suffer from attentions of fish crows.

Quite different from Mr. Ridgway's experience with house wrens is that of Mr. Gilbert H. Grosvenor, at his summer home, Wild Acres, in Maryland, a few miles from Washington, D. C. Here, as a result of several years' endeavors, he has a colony of house wrens which in 1915 numbered 19 pairs, all in boxes put up for them in the immediate neighborhood of the house, and yet other birds also were numerous, and in the 5 acres surrounding the house there nested, in 1915, the following additional pairs: Flicker, 3; southern robin, 8; catbird, 3; bluebird, 3; orchard oriole, 2; yellow warbler, 1; brown thrasher, 1; chipping sparrow, 3; phœbe, 2; barn swallow, 1; indigo

[1] Ridgway, Robert, Bird-Life in Southern Illinois. Bird-Lore, XVII, 1–7, 91–103, Jan.–April, 1915.

bunting, 1; grasshopper sparrow, 1; song sparrow, 2; meadowlark, 1; red-headed woodpecker, 1; kingbird, 2; field sparrow, 1; Carolina wren, 1; Maryland yellow-throat, 1; screech owl, 1; towhee, 1; English sparrow, 6; and last, but not least, a flourishing colony of 70 pairs of purple martins; in all a total of 24 species and 135 pairs on the 5 acres—the 1915 record for density of bird population.[1]

The report of the 1914 bird counts credited Chevy Chase, Md., as having the highest record for that year. This same area in 1915 showed a satisfactory increase in the number of nesting birds, the kinds and the pairs of each being as follows: Southern robin, 19; Carolina chickadee, 2; tufted titmouse, 2; white-breasted nuthatch, 3; cedar waxwing, 2; cardinal, 2; song sparrow, 12; field sparrow, 1; goldfinch, 1; meadowlark, 1; blue jay, 3; red-headed woodpecker, 3; downy woodpecker, 1; screech owl, 1; bob-white, 1; purple grackle, 13; flicker, 3; mourning dove, 1; chipping sparrow, 9; towhee, 1; brown thrasher, 4; chimney swift, 3; house wren, 14; oven-bird, 1; yellow warbler, 1; Maryland yellow-throat, 2; redstart, 2; catbird, 17; wood thrush, 14; yellow-throated vireo, 4; red-eyed vireo, 11; kingbird, 1; crested flycatcher, 1; scarlet tanager, 2; indigo bunting, 1; orchard oriole, 1; Baltimore oriole, 1; wood pewee, 8; yellow-billed cuckoo, 1; English sparrow, 19; a total of 40 species and 189 pairs on 23 acres. A half-acre lot in this area belonging to Dr. S. W. Mellott was the home during 1915 of 20 pairs of birds representing 14 different species, 4 wood thrush nests being the greatest number of any one kind.

A few miles from Indianapolis, Ind., is a tract of 44 acres, known as Woollen's Garden, set aside in 1897 as a bird sanctuary, one of the first—if not the first—of the kind in the United States. In 1909 this was deeded to the city of Indianapolis to be maintained perpetually as a public park where bird life should be carefully protected. It consists of 12 acres of cleared and cultivated land and the remainder of heavily wooded hills and ravines. During 1915 the following pairs of birds nested within its limits: Robin, 4; crested flycatcher, 8; wood pewee, 4; wood thrush, 10; tufted titmouse, 8; cerulean warbler, 10; yellow warbler, 2; redstart, 3; Kentucky warbler, 2; hooded warbler, 1; worm-eating warbler, 1; yellow-breasted chat, 1; Maryland yellow-throat, 2; sycamore warbler, 1; oven-bird, 11; red-headed woodpecker, 1; downy woodpecker, 4; bluebird, 1; phœbe, 3; blue jay, 2; catbird, 2; brown thrasher, 1; bronzed grackle, 2; field sparrow, 4; chipping sparrow, 5; song sparrow, 2; vesper sparrow, 2; grasshopper sparrow, 2; red-eyed vireo, 10; warbling vireo, 3; yellow-throated vireo, 3; cardinal, 3; flicker, 2; indigo bunting, 7;

[1] Mr. Grosvenor gives an interesting account of the birds enumerated on Wild Acres, in Bird-Lore, XVIII, 77–84, March–April, 1916.

belted kingfisher, 1; chimney swift, 8; crow, 8; kingbird, 1; sparrow hawk, 1; red-tailed hawk, 1; goldfinch, 12; ruby-throated hummingbird, 3; mourning dove, 2; towhee, 4; yellow-billed cuckoo, 2; green heron, 1; cedar waxwing, 2; killdeer, 1; spotted sandpiper, 1; nighthawk, 2; Acadian flycatcher, 1; alder flycatcher, 2; least flycatcher, 1; Carolina wren, 1; Bewick wren, 2; house wren, 1; whip-poor-will, 2; barred owl, 1; Carolina chickadee, 1; Baltimore oriole, 1; blue-gray gnatcatcher, 1; scarlet tanager, 2; a total of 62 different kinds of birds represented by 193 nesting pairs. This is by far the highest record of all the reports received, in the variety of bird life, but in the average of pairs per acre it is exceeded by several.

These examples, given in detail, show bird lovers what surprisingly satisfactory results may follow persistent and intelligent efforts to attract birds.

SUMMARY.

The second count of the birds of the United States corroborates in general the results obtained by the preliminary work of 1914.

In northeastern United States the average farm contains 108 acres. If the counts in 1915 covered 64 acres, showing a bird population on this part of the farm of 80 nesting pairs, and a probable 44 pairs on the remaining 44 acres, the total of 124 pairs might be credited to the farm of 108 acres.

An average of the returns of counts shows that on farms where counts were made in that part of the Plains region east of the one hundredth meridian and in the whole of the Southern States, for the part of the farm surrounding the farm home there is almost exactly the same density of bird population—for the former, 125, and for the latter, 131 pairs of nesting birds to each 100 acres—but the counts so far received do not furnish a sufficient basis for estimating the birds on the remainder of the farm.

The data received tend to indicate that the western part of the Plains, the Rocky Mountain region, and the Pacific slope contain a smaller number of birds per acre than the Eastern States, but as yet no numerical statement may be attempted.

The further counts made in 1915 emphasize the statement of a year ago, that birds are too few on the farm and that their numbers may be largely increased by protection and a little care in furnishing natural food and shelter. A bird population of 70 pairs of native birds of 31 species on 8 acres, at Olney, Ill.; 135 pairs of 24 species on 5 acres, at Wild Acres, Maryland; 193 pairs of 62 species on 44 acres, at Indianapolis, Ind.; and 189 pairs of 40 species on 23 acres, at Chevy Chase, Md., a half acre of which showed 20 pairs of 14 different species, all indicate how largely birds will respond to food, shelter, and protection.

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